The Research Base for

Science Notebooks

White Paper

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Note taking is considered a fundamental skill for successful learning within an academic setting. Numerous studies have documented that note-takers perform better on information retrieval than students who do not take notes, especially over the long term (Kiewra, DuBois, Christian, McShane, Meyerhoffer, & Roskelley, 1991; Titsworth, 2001; Weiland & Kingsbury, 1979). Some of these studies have specifically documented recording notes as an effective technique for increasing information retention by middle school and secondary school students (Bretzing, Kulhavy, & Caterino, 1987; Faber, Morris, & Lieberman, 2000).

Note taking enhances learning in a number of ways. Initially, it serves to focus the learner's attention on the material being presented in a lecture setting, a written document, or media presentations (Rickards, 1997). Researchers believe that the actual process of taking notes in combination with this focused attention assists students in encoding the new information (Kiewra et al., 1991; Ruhl & Suritsky, 1995). Active note taking results in better comprehension of text (Katayama & Robinson, 2000; Rickards, 1997; Weiland & Kingsbury, 1979) and improvement of information recall (Katayama, Shambaugh, & Doctor, 2005; Rickards, 1997; Ruhl & Suritsky, 1995). Note taking that involves significant levels of student engagement, such as problem solving, self-questioning, or reorganizing material, is most effective (Trafton & Trickett, 2001). The notes generated also serve as a form of external storage, allowing for reference and review, which can lead to even greater comprehension and content understanding (Ganske, 1981). However, the greatest indicator of student performance associated with note taking is whether students take advantage of the opportunity to review (Kiewra, 1985a, 1985b; Kiewra et al., 1991; Kobayashi, 2006).

Unfortunately, the majority of students are poor note takers. Many of them write notes verbatim, do not record key points, demonstrate little organization, and fail to summarize. Various models of strategic note taking have been developed that can help learners address these issues. Most of these strategies serve to positively influence student performance by increasing the efficiency of note taking and the identification of main ideas through the use of cues and review. Use of strategic note taking is especially important for learning disabled (LD)

students and English language learners (ELL) because it allows them to focus on the material presented rather than becoming bogged down in the process of recording (Boyle, 2001). The application of strategic note taking also allows for higher order learning for all students through building connections within content and across subject matter (Kiewra, 1985a).

Even when students use the same note-taking approach, those who receive instruction perform significantly better than those who do not receive the training (Faber et al., 2000). Given the importance of effective note taking in student learning, it is imperative that students receive instruction in successful strategies. However, in a 2002 poll, only 50% of the nation's middle and high school students had received adequate instruction in note-taking skills (Curriculum Review, 2002, 10). Williams and Eggert (2002) contend that "notetaking is among the most powerful contributors to performance in courses having a strong content base" (193) and students need to be made aware of its value (Fisher & Frey, 2004; Garcia-Mila & Andersen, 2007). Providing students with cues on what to record is also an important factor in successful notetaking (Garcia-Mila & Andersen, 2007; Gray & Madson, 2007; Ladas, 1980). Glencoe/McGraw-Hill has developed the *Science Notebook* as a resource for teachers to use with students in their science classes to increase content understanding through the development of effective note-taking skills.

The *Science Notebook* series incorporates Cornell Note Taking as one of its main components. The Cornell Note Taking method is a form of strategic note taking that has garnered a great deal of interest throughout the educational community, and its use is supported by research results. This note-taking approach was developed by Walter Pauk, a professor of education at Cornell University, to help college students take better lecture notes. This same note-taking strategy is equally effective in taking notes from written materials (Darrow, 2005; Faber et al., 2000) and has been recommended as a strategy for helping K–12 students bridge the gap between their reading levels and the reading levels of their textbooks (Edwards, 1987). Cornell Note Taking is a proven method for helping students distinguish between general and specific ideas and is especially useful for those students lacking in organizational skills (Bakunas & Holley, 2004). It has been recommended for student use by The College Board and numerous college and university study skill Web sites and has been adopted by many school districts

targeting increased student performance. AVID (Achievement via Individual Determination) is a nationwide program designed to help middle school and high school students in the academic middle prepare for college. One of the strategies employed by AVID is instructing program participants how to take Cornell Notes. This method of note taking is used by all participants in all subject areas and was selected because the use of prompts and questions promotes active learning and increases comprehension (Nelson, 2007). The Cornell Note Taking approach is generally well received by students. Most students in Herbert Hoover High School, San Diego, chose to use Cornell Note Taking when the school implemented structured note taking as part of a school wide commitment to literacy (Fisher, Frey, & Williams, 2002). A customer satisfaction survey conducted among secondary school students indicated that the Cornell Note model was viewed positively by the students (Horton, Lovitt, & Christensen, 1991).

The general framework of the Cornell Note Taking method is a two-column approach, with the left-hand column devoted to the notation of cues and main ideas while the right-hand column is dedicated to the recording of details. A third section created across the entire width of the bottom of the page can be used for summarizing. This model of note taking is designed to create a structure that enables organization and encourages students to use cues to recall information, record reflections, identify main ideas and connections, and review, all of which have been identified as critical components of good study skills (Pauk, 2001). This method has been proven to be useful for students across ability levels and subject area.

Freshmen at Franklinton High School demonstrated an increase in academic performance after a semester of using the Cornell Note Taking method (http://www.fcschools.net/releases/Cornell%20Notes%20PowerPoint%20for%20Board.ppt). In another study, high school geometry students who used a columnar note-taking method versus other approaches made the most effective use of their notes for understanding (Walmsley & Hickman, 2006). Columnar note taking was also found to be an effective way for secondary science students of all ability levels to glean the important information from their textbooks. Of special note is the dramatic improvement in performance by the students with learning disabilities once they were introduced to this note taking strategy (Horton et al. 1991).

Application of the basic Cornell Note Taking structure is readily apparent within the *Science Notebook* series and provides an organized approach to external storage and efficient review.

This structure is enhanced by question prompts that provide important cues to aid students in identifying key ideas. The model presented encourages the identification of main topics and summarization. Graphic organizers, such as concept maps and Venn diagrams, are also embedded within the columnar note-taking approach.

Graphic organizers provide a visual representation of information and connections between ideas. Because of this, graphic organizers are important tools for learning complex or nonlinear science concepts (Fisher & Frey, 2004). Use of graphic organizers during and after readings has been effective at increasing student comprehension (Shanahan, 1982). Adding the opportunity for students to store text information in spatial formats may provide them with an additional path for retrieving information and increase their ability to recall information (Katayama & Robinson, 2000). Visual representation of information also addresses variations in learning styles among students (Walmsley & Hickman, 2006). This form of strategic note taking is a recommended method of helping students improve their study skills (Callison, 2001; Lambert & Nowacek, 2006) and is especially helpful for students with learning disabilities (Fisher & Frey, 2004). Students at Hoover High School reported that graphic organizers were the most helpful strategy they used (Fisher et al., 2002).

Partial graphic organizers, such as those included in the *Science Notebook* series, are most effective for helping students understand and apply the greatest number of concept relationships and are preferable to giving students completed notes because they provide the benefits of encoding while supplying cues for the identification of important information (Katayama & Robinson, 2000; Robinson, Katayama, Beth, Odom, Ya-Ping, & Vanderveen, 2006). Completion of partial graphic organizers has been shown to increase student use of them in learner directed note-taking sessions and to increase performance on exams (Robinson et al., 2006).

Another strategy incorporated into the Cornell Note Taking format in *Science Notebooks* is SQ3R (survey, question, read, recite, review). SQ3R models the reading behaviors of effective readers and provides a systematic approach for students to apply to their textbooks and translate the reading into notes (Fisher & Frey, 2004). This strategy for integrating reading and writing has been recommended both as an approach for engaging science students (Martin, 2002) and developing reading across the curriculum (Edwards, 1987).

The *Science Notebook* series includes additional study skill approaches outside of the Cornell Note Taking system. Each lesson begins with a section on vocabulary development. Word knowledge has a significant impact on content learning and reading comprehension (Flood, Lapp, Squire & Jensen, 2003). Incorporating strategies that encourage students to learn new vocabulary is recommended for increasing subject matter understanding (Edwards, 1987; Fisher & Frey, 2002).

Educational theory suggests that student learning involves scaffolding of new information onto prior knowledge. K-W-L charts ask students to record *What do you know?* and *What do you want to know?* prior to the introduction of new information (Ogle, 1986). This type of advance organizer activates prior knowledge and increases students' interest in the reading (Eggen & Kauchak, 2001). Completing the *What did you learn?* section helps students review their reading and apply the new knowledge. Other forms of anticipation guides included in *Science Notebooks* similarly increase student engagement in the associated readings.

Journal entries provide opportunities for students to link new information to their individual experiences and provide an environment for the encoding of information and the development of internal connections (Martin, 2002). The Connect and Tie It Together features create additional settings for students to develop connections between content information while further developing their writing skills. References to Foldables™ by Dinah Zike presented in the associated textbook reinforce the connection between the text, note taking, and review. Chapter Wrap-up and Review features reinforce cues for the identification of key concepts and increase student use of notes as external storage.

Efficient note taking and review is critical to the process of encoding information, and ultimately, student success. The Cornell Note Taking system has proven to be a successful model for achieving this goal. Additional strategies employed in the *Science Notebooks* further support student learning by increasing access to information, reinforcing the essential review process, providing opportunities for linking to prior knowledge, and creating additional writing scenarios that encourage the encoding of information. The many features included in the *Science Notebook* series combine to form a framework that assists students in developing effective study skills and supports student learning in the content areas—ultimately contributing to the development of the successful learner.

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